Mapping Potential Native Plant Communities of Minnesota's Laurentian Mixed Forest

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Understanding the types and distribution of Native Plant Communities (NPC) is important for understanding the potential of the landscape for providing ecological, economic and social benefits. Over time, plant communities have adapted to particular combinations of soil, landform and disturbance regimes that recur in characteristic landscape positions, and a large body of research has gone into characterizing the species composition, successional pathways and productivity of NPCs. NPCs provide a fundamental basis for planning by the MN Department of Natural Resources, the US Forest Service, counties and other land management groups.

There have been numerous efforts to map NPCs, both through field evaluation and mapping, as well as through predictive mapping by analyzing layers within a GIS. Most of these latter analyses have been conducted at spatial scales ranging from counties to Ecological Sections. The project presented here attempts to integrate previous efforts from the Northern Superior Uplands (NSU) and Minnesota-Ontario Peatlands (MOP) with a more spatially resolved map of the Drift and Lake Plains (DLP) and new maps for the Western and Southern Superior uplands (WSU, SSU). These five Sections comprise the Laurentian Mixed Forest Province, so the end product is a map of the most probable NPCs across the LMF with a common legend and consistent spatial resolution.

Maps for the DLP, WSU and SSU were created by assessing the statistical relationships between MN DNR relevee plots and a suite of GIS layer that are important factors that structure NPCs: soil variables, landform, climate, presettlement composition, wetlands, and other predictive map layers. The statistical model was developed using a technique called recursive partitioning, a type of decision tree model that identifies combinations of predictor variables to classify different NPCs within the relevee data set. In a second step, the statistical model was applied within a geographic information system grid to assign the most probably NPC to grid cells across the LMF area. The final phases of analysis refined the discrimination between upland and lowland sites and attempted to make predictions of NPC Systems and Classes that had low sample sizes in the relevee database.

The NSU map created by White and Host (2000) classified map polygons according by "Landscape Ecosystem", which are the Range of Natural Variation Ecosystem classes described in Frelich 1999. These classes predated the MN DNR Native Plant Community classes. To create a crosswalk between the two classification schemes, we assessed the percentages of relevee plots that within the Landscape Ecosystem classes, and selected the dominant system and class, leading to the crosswalk shown in Table 1.

The end products of the analyses are grid-based maps of the most likely NPC class and system for each pixel. The accuracy of the maps is influenced by a number of factors, including the spatial and classification accuracy of the relevees themselves, scale and accuracy of the environmental data, and the ability of the recursive partition method to identify relationships between these two data sets. An important factor influencing classification accuracy was the difficulty in separating upland and lowland landscape positions. Basing the upland/lowland mask simply on the National Wetland Inventory (NWI) gave high rates of misclassification. Accuracy issues with the NWI are well-known, and NWI polygons are relatively coarse compared to the 30 m resolution of the input data. We

attempted to correct this by incorporating other data layers, such as the soil drainage categories of the SSURGO data, the classification of lowland types by the MN DNR GAP program, and the Compound Topographic Index (CTI), an indicator of potential soil moisture. This strategy ameliorated but did not fully resolve confusion between upland and lowland sites, or more correctly, the broad areas of transitions between clearly upland and clearly lowland areas.

Table 1. Crosswalk of Landscape Ecosystems to NPC Systems and Classes for the Northern Superior Uplands.

Landscape Ecosystem (Frelich RNV classes)	NPC System	NPC Class
Mesic Northern Hardwood-Conifer	MH	MHn45
Mesic Conifer-white,red pine (north shore)	FD	FDn43
Dry-mesic conifer-white-red pine (bwcaw)	FD	FDn43
Near boreal mesic-paper birch,aspen,b. spruce, b. fir	FD	FDn43
Near boreal dry forest-jack pine, b. spruce	FD	FDn32
Near boreal dry forest-jack pine, aspen, pin oak, bur oak	FD	---
Wet mesic-boreal hardwood-conifer	MH	MNn44
Lowland conifer-black spruce	FP	FPn62
Rich swamp-white cedar, black ash	WF	---

--- not enough data to identify Class

The maps are delivered at full (30 m) resolution, which gives a high level of apparent spatial resolution, certainly more than warranted by the scale of input data layers (e.g. soil series polygons, LTAs, Marschner presettlement vegetation map) and the various sources of error noted above. This is by intent to allow end users to make their own decisions on the degree to which the map should be generalized. For example, the data can be summarized with larger grid cell sizes or dominant NPC can be determined for a forest stand or other map unit of interest.

The intent of developing this map across the LMF was to provide support for broad-scale regional planning exercises (specifically the Forest Resources Council Landscape Program), and is of variable accuracy at fine spatial scales; some portions of the landscape are modelled well, others, such as discriminating between Acid and Open Peatland, will need continued refinement. As a result, the maps are best used for broad-scale assessments, or, at the site level, as exploratory tools to be used in conjunction with other data sources. They do not substitute for field assessment, and should not be used as a sole source of information for site-level management. The map is however, a first attempt at mapping the entirety of the Laurentian Mixed Forest Province. It resolves a long-standing spatial resolution issue of the Drift and Lake Plains, creates new maps for the Western and Southern Superior Uplands, and provide a crosswalk with the NSU classification. As such, it provides a base map for successive refinement as new remote and field based data become available.

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